

1

Research Triangle Park, NC

April 30, 2019

INGAA - EPA Meeting on Subpart OOOOa Proposed Amendments

2

Agenda

- Introductions

- Quick review of LDAR issues in INGAA's comments

- ☐ LDAR surveys should be completed with operations as found

- ☐ LDAR - Modification should be based on compressor HP

- ☐ LDAR delay of repair should account for rare scenarios

- ☐ LDAR frequency and related TSD analysis and INGAA technical documents are discussed in detail in the following slides

- ☐ Other items in INGAA Comments are not planned for discussion today unless EPA has questions

- Primary Objective: Develop a common understanding of INGAA technical reports related to LDAR / TSD analysis

2

3

LDAR Surveys - Operations

- LDAR surveys should be conducted with compressor operations as they are found

- ☐ Interstate pipelines are designed (and regulated by FERC) to meet peak demand

- ☐ Transmission compressor stations typically include multiple compressors, and the operating mode of each unit is dependent on pipeline demand

- ☐ Requiring surveys to be conducted with compressors in a particular mode (e.g., operating) will:

- significantly complicate survey logistics and costs; operating mode may not be feasible for some units (e.g., undergoing major maintenance / overhaul)

- likely require cycling units on and off to accommodate mode-specific survey requirements

- likely result in additional vented emissions that exceed emissions from potential leaks associated with a particular mode

4

LDAR - Modification Definition

- EPA solicited comment on the definition of modification

- INGAA recommends:

- ☐ basing the definition of "modification" on compressor horsepower (not engine horsepower)

- ☐ amending the rule text to conform with preamble text that is clearer

3

5

LDAR - Delay of Repair

- INGAA continues to support additional revisions to delay of repair and recommends amendment that would:

- ☐accommodate rare circumstance where availability of parts may affect repair timing

- ☐remove "planned vent blowdown" as a trigger for repair

6

LDAR: EPA & INGAA Dialogue on LDAR and TSD Analysis

- INGAA provided technical documents in mid-2018 addressing survey frequency on LDAR performance and TSD analysis related to transmission and storage leak emissions and mitigation

- ☐Reviewed available data on leak emission and mitigation

- ☐INGAA submitted a supplemental memo and revisions

- EPA prepared a memo that reviewed INGAA's documents

- ☐EPA-HQ-OAR-2017-0483-0038, "EPA Analysis of Fugitive Emissions Data Provided by INGAA"

- Appendix A to INGAA's Dec. 2018 comments responded to EPA's memo

4

7

LDAR - Survey Frequency

- INGAA supports decreasing the frequency of LDAR surveys for transmission and storage (T&S) compressor stations

- For T&S, the best available data indicates annual LDAR surveys can achieve 75 - 80% reduction in leak emissions

- INGAA's analysis was based on a review of available information, reports, etc.

- ☐For T&S (and other operations), there is no definitive data / reports on the influence of survey frequency on performance

- ☐The CAPP Study appears to be the best resource available

8

LDAR - Survey Frequency

- EPA has expressed concerns about deficiencies in the CAPP Study, raised methodology questions, and questioned leak survey methods.

- INGAA believes the CAPP Study and data are preferable to other available sources

- ☐Benefits of the CAPP Study: data is from natural gas operations, more recent than other sources, includes all component types and more surveyed components

- ☐Deficiencies in other sources: older data, from other industry segments, and select / fewer components

- ☐The CAPP Study uses established methods (e.g., Method 21, OGI) for detecting leaks and actual measurement of leak emission rates

5

9

LDAR - Survey Frequency

Comparison of CAPP Study & EPA Leak Protocol Model example calculations

Parameter

CAPP Study

EPA Leak Protocol Model

Annual LDAR CE

75 - 80%

42 - 68%

(40% assumed for OGI)

LDAR CE basis

Emissions directly measured and calculated from M21 surveys & M21 SV-based emission factors (EFs)

Example calculations based on a theoretical model

Components controlled

Valves, emergency vents, PRVs, OELs, flanges, connectors, compressor seals, blowdown systems.

Valves only

Years data collected

2007 +

Data reports published

1980 - 1982

Industry / Process streams

Oil and gas

Synthetic organic chemical manufacturing industry (which includes corrosive streams atypical of oil and gas)

Data set size

120 facilities over multiple years; ~250,000 components

Leak occurrence rate based on 71 gas service valves

10

LDAR - Survey Frequency

- INGAA raised concerns about the models and assumptions used in the TSD analysis, which concluded 40% control efficiency (CE) for annual surveys

- Subpart OOOOa TSD LDAR CE estimates were not based on measured leak emissions reductions:

- ☐CAQCC LDAR Cost-Benefit Analysis "data" that are the basis for the August 2015 TSD LDAR CE estimates

- Concern about circular reference in the EPA TSD citing CAQCC which cites "EPA reported information" which is understood to be the..

- ☐EPA Leak Protocol LDAR CE Model leak emission reduction calcs

- Concern about unrepresentative data and assumptions

- ☐An ICF Study model-based estimate

- Concern about inputs and assumptions, and lack of report (only PPT slides provided in docket)

- In contrast, the CAPP Study includes leak rate measurements

6

11

LDAR - TSD Analysis

- LDAR costs

- ☐Concerns about emissions over-estimates and repair cost under-estimates

- ☐TSD cost-effectiveness estimates (\$/ton  $\Delta$  CH<sub>4</sub>) could be about a factor of 10 low (due to high-bias in the TSD Model Plant CS emissions and low bias in the TSD LDAR implementation cost estimates)

- ☐Model Plant does not include all leak emission sources

- If the TSD Model Plant is revised to include all covered leak sources, then repair costs for blowdown valves, isolation valves and other compressor components should be analyzed. Repair or replacement costs for these components can be orders of magnitude greater than repair costs for non-compressor components.

- Emissions estimates

- ☐Sources / components included in "leak emissions" causes confusion

- ☐Method 21 / OGI and implications of large leaks

12

LDAR - TSD Analysis (Leak Emissions)

- Key themes in INGAA documents regarding leak emission estimates

- ☐Methods for detecting and estimating leaks; uncertainties in emission estimates

- ☐Consistent results for natural gas operations that show few leaks are responsible for the majority of leak emissions

- ☐New data is available - Subpart W leak rate measurement data compilation by PRCI that shows compressor leak emissions are lower than historical estimates

- ☐Leak emissions inventory in TSD Model Plant and various studies: Differences in how TSD / studies present leak emissions - facility leaks, compressor leaks, etc.

7

13

LDAR - TSD Analysis (Leak Emissions)

- PRCI report compiled Subpart W data

- ☐Analyzed over 10,000 compressor measurements

- ☐data shows that compressor leak emission factors are lower than other estimates

- ☐analysis confirmed that few leaks contribute most emissions

- LDAR regulations that require repairing all leaks, even very small leaks, based on a prescribed schedule may cause a net emissions increase (e.g., emissions from vehicle use or equipment blowdown for safe repair)

- Additional discussion?

14

LDAR - TSD Analysis (Leak Emissions)

- Primary leak detection methods are Optical Gas Imaging (OGI) and EPA Method 21 (M21) screening value (SV) measurements

- Leak detection / leak emissions estimation is an inexact science. Leak survey results are impacted by numerous technical and human parameters

- Gas leak studies consistently show:

- Leak rates measured for a M21 SV can vary by several orders of magnitude, and SV is a weak surrogate for actual leak rate

- Most gas leak emissions are from a small fraction of large leaks

-A large fraction of detected leaks have very small leak rates & a very small/negligible cumulative contribution to total emissions

-Most large leaks have very high or pegged SVs, and leaks with SVs < 10,000 ppmv have a very small/negligible contribution to total emissions

8

15

LDAR - TSD Analysis (Leak Emissions)

- Leak detection and emissions estimation is an inexact science
- Leak rates measured for a M21 SV can vary by several orders of magnitude
- Measured leak rate data is preferred to estimates based on M21 SV
- SV is a weak surrogate for actual leak rate

□60 g/hr of 10,000 ppm C1/C3 (OGI "DL") corresponds to 6.0E-4 kg/hr

16

LDAR - TSD Analysis (Leak Emissions)

- The vast majority of emissions are from a small number of leaks. E.g.,:
- ~ 50% of emissions are from ~ 2 - 3% of the leaks,  
□~ 90% of emissions are from ~ 15% of the leaks  
□AND, ~ 1% of emissions are from ~ 50 - 60% of the leaks

9

17

LDAR - TSD Analysis (Leak Emissions)

A few large leaks contribute the vast majority of emissions.

See results from 5 large O&G systems leak studies.

Leak Study

ΣLeakers/

ΣComponentsA

ΣSV > 10,000

Components/

ΣComponentsB

% of Leakers

with 1% of

EmissionsC

% of Leakers

with 50% of

EmissionsD

% of Leakers

with 90% of

EmissionsE

ΣSV > 10,000

Emissions/

ΣEmissionsF

EPA Leak Protocol 2.6% 1.2% 66% 2.5% 15% 99%

CAPCOA/CARB DNA 2.2% DNA DNA DNA 98%

Clearstone I 2.6%x 2.6% x 51% 1.2% 13% 100% x

Clearstone II 2.2%x 2.2%x 54% 1.3% 15% 100% x

CEC/CSUF 0.41% 0.28% 53% 2.4% 16% 97%

A. Total number of components detected leaking / total number of components surveyed

B. Total number of components detected leaking with SVs > 10,000 ppmv / total number of components surveyed

C. Percent of (smallest) leaking components with summed emissions that are 1% of the total study emissions

D. Percent of (largest) leaking components with summed emissions that are 50% of the total study emissions

E. Percent of (largest) leaking components with summed emissions that are 90% of the total study emissions

F. Summed emissions from leaking components with SVs > 10,000 ppmv / total study emissions

DNA - data not available

x. Leak defined as SV >10,000 ppm

18

Discussion

and Questions

10

19

Additional Detail / Back-up Slides

Excerpts from EPA Memo and INGAA responses

20

LDAR for Natural Gas Systems CAPP Study Data

In the EPA memo titled "EPA Analysis of Fugitive Emissions Data Provided by INGAA", EPA states

"These (CAPP) BMPs were not an enforceable regulation, and did not specify a leak definition, monitoring frequency, repair timeline, the components to monitor, or require a specific technology or method of detection."

Regarding these EPA concerns:

- were not an enforceable regulation - the primary data evaluation criteria should be dataset size, quality/reliability (e.g., technical approach) and representativeness of the covered sources. Background data for many regulations are based on data that were not collected to comply with an enforceable regulation (e.g., when a new emissions source is regulated). Further, the TSD data and analyses from the EPA Leak Protocol and the CAQCC were not collected to comply with an enforceable regulation.

- and did not specify a leak definition - Refer to Section 3.2 of the CAPP BMP. Leak detection by Method 21 (10,000 ppm or less), differential lasers, infrared optical technology to visually inspect the components (OGI), or computer analysis of ambient air sample trends. Repair decision based on procedures and logic outlined in Figure 1 of the BMP (i.e., repair based on health, safety, or environmental concerns or leak

rate measurement and repair cost-effectiveness analysis).

11

21

- monitoring frequency - BMP Section 3.2.6 states "The equipment components most likely to leak should be screened most frequently. Studies indicate that components subject to vibration, high use, or temperature cycles are the most leak-prone. Operators should develop a DI&M survey schedule that achieves maximum cost-effective fugitive emissions reductions yet also suits the unique characteristics and operations of their facility."

- Appendix 1 the BMP provides leak detection survey frequency guidance for various "leak-prone" equipment components. Annual surveys are recommended for control valves, block valves, emergency vents, PRVs, and OELs. Quarterly surveys are recommended for compressor seals and blowdown systems. Other components that are less "leak-prone," such as flanges and connectors, are likely surveyed annually or less frequently.

LDAR for Natural Gas Systems CAPP Study Data

22

LDAR for Natural Gas Systems CAPP Study Data

- repair timeline, BMP Section 3.2.1 states "Once a leak is determined to need fixing, this should be done within a reasonable period of time (see Section 3.2.9), or at the next facility turnaround if a major shutdown is required."

Section 3.2.9 states "Decisions to repair or replace leaking components should be made on a case-by case basis in consideration of health, safety, environmental, and economical concerns. Where feasible, repairs or replacements should be done within 45 days from the time a leak is detected. Where a major shutdown is required to facilitate this work, or there are marginal economics for repairing the component, the repair or replacement may be delayed until the next planned shutdown, provided this does not pose any safety, health, or environmental concerns. A leaking component need not be repaired if the component is shown to be uneconomical to repair and does not pose a safety, health, or environmental concern. In such cases, the components should remain tagged/identified and be rescreened at the next scheduled leak survey."

12

23

LDAR for Natural Gas Systems CAPP Study Data

- components to monitor - Both Subpart OOOOa and the CAPP BMP require leak monitoring of all components that are potential sources of fugitive emissions.

§ 60.5430a

BMP 3.2.5 Target Components

"Fugitive emissions component means any component that has the potential to emit fugitive emissions of methane or VOC at a well site or compressor station, including but not limited to valves, connectors, pressure relief devices, open-ended lines, flanges, covers and closed vent systems not subject to §60.5411a, thief hatches or other openings on a controlled storage vessel not subject to §60.5395a, compressors, instruments, and meters."

"All equipment components on process-, fuel- and waste-gas systems are potential sources of fugitive emissions. The types of components may include flanged and threaded connections (i.e., connectors), valves, pressure-relief devices, open ended lines, blowdown vents (i.e., during passive periods), instrument fittings, regulator and actuator diaphragms, compressor seals, engine and compressor crankcase vents, sump and drain tank vents and covers."

24

LDAR for Natural Gas Systems CAPP Study Data

- require a specific technology or method of detection. Refer to Section 3.2 of the CAPP

BMP. Leak detection by Method 21 (10,000 ppm or less), differential lasers, infrared optical technology to visually inspect the components (OGI), or computer analysis of ambient air sample trends. It is reasonable to assume that the great majority of leak surveys were conducted using Method 21 or OGI.

As noted above, the CAPP data is not perfect but is best available science